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Two 4-year-old children were shown the use of an apparatus whereby they could obtain toys and candy by making certain responses. The apparatus was a matching-to-sample device on which were arranged five response buttons in a circle and one in the middle. Each response button had a display window for the stimulus. Four of the five windows on the circle were lighted, and one contained a stimulus matching the center stimulus. The fifth window on the circle remained dark. During training, a matching and nonmatching condition was alternately reinforced. One stimulus was never reinforced and represented a neutral stimulus. It was found that during reinforcement of not matching, nonmatching responses to the stimuli increased, even for the neutral stimulus. When matching was reinforced, matching behavior increased for all four stimuli. On the basis of these results, it was concluded that response generalization was demonstrated. (WD)

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The University of Kansas Head Start Research and Evaluation Center

IX.

"Development of 'Matching' Abstractions in Young Children."

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Development of Generalized Matching or Mismatching Repertoires in Young Children[1]

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ABSTRACT

Two children were reinforced for matching or mismatching certain sample stimuli. When reinforcement was delivered contingent upon matching responses to certain sample stimuli, the children showed an increased amount of matching other sample stimuli in the absence of direct reinforcement for these matching responses. When reinforcement was delivered contingent upon mismatching responses to certain sample stimuli, the children showed an amount of mismatching other sample stimuli in the absence of direct reinforcement for these mismatching responses. The results indicate that the procedures employed established generalized repertoires of matching or mismatching responses. The results indicate that the procedures employed established generalized repertoires of matching or mismatching in these children.

Development of Generalized Matching or Mismatching Repertoires in Young Children

INTRODUCTION

An "abstraction" may be defined as the differential responding of a subject under the control of a specific stimulus property of an object or number of objects. For example, light of certain wave length (or within a certain wave length range) reflected from any kind of object may control the verbal response "red". The variety of objects in terms of shape, area, volume, etc. which control this verbal response may be infinitely large, yet each one is responded to as "red". In this example, the abstraction is under the stimulus control of only one characteristic of the object, namely, the wave length of light reflected from it. Other types of abstractions are those formed along a relative dimension between two or more objects. That is, abstractions of "larger than", "smaller than" or "equal to" with respect to the comparative height, width, area, etc. of objects might be established in subjects. The simple type of abstractions cited above are an important aspect of the educational training of most children, since the more complex abstractions which are the heart of educational training are based upon these simple types of abstractions. However, in many children (e.g., the autistic, the retarded and the culturally deprived) these simple abstractions are either not developed or are developed late which inhibits the more complex learning dependant upon simple abstractions.

Important in an analysis of abstractions, is an examination of the effects of previous training upon generalization to other situations. The purpose of this study was to develop a simple relational abstraction of "matching" or "mismatching" in children and to investigate some of the experimental conditions in which this abstraction generalized to situations which were not explicitly involved in the training procedures.

METHOD

Subjects and Apparatus:

The subjects were two children (one male and one female) approximately four years old, who were enrolled in the University of Kansas Preschool. The apparatus was a six-position matching-to-sample device on which were arranged five response buttons in a circle with a single response button in the center. Each response button had a display window immediately above it upon which visual stimuli were displayed. The stimuli used were straight lines which were tilted at various inclinations from vertical (0, 30, 60, and 90 degrees). To the left of the response panel was a chute through which marbles could be delivered into a plastic cup. The presentations of stimuli, the marble delivery and recording of responses were controlled by standard electromechanical programming and recording equipment.

PROCEDURE:

Initial procedure:

Each subject was brought into the experimental room and shown a box with a variety of toys and candy in it. They were told that by working at

at the match-to-sample panel they could earn marbles which could be traded for any toy or piece of candy they wanted after the session was over. Then each subject was seated before the match-to-sample panel (upon which a sample stimulus was displayed) and the experimenter demonstrated how the apparatus worked. The experimenter first pressed the center button under the illuminated sample stimulus and produced the choice or match stimuli on the circle of display windows surrounding the sample window. The experimenter then pressed the match button under the stimulus identical (in terms of angle of rotation) to the displayed sample stimulus; a marble was delivered through the chute, and the next sample stimulus was displayed on the center window. The subject was then told to first press the button in the middle and when the choice stimuli were produced on the outside circle, to press the button under the line which was the same as the line in the middle. When the subject went through the response sequence a marble was delivered, the experimenter left and the session began. In subsequent sessions the subject were only given instructions as to how many marbles were required to get a toy or piece of candy.

In all sessions a press to the sample button resulted in the presentation of line stimuli on four of the match display windows, while one match display window remained dark (she sample stimulus remained illuminated). A press to a match button under an illuminated display always resulted in the match display being darkened and the presentation of a new sample stimulus. A press to the match button under the dark display always resulted in a five second period in which all of the displays were dark and responses to any button produced no programmed consequences. The purpose of this "time-out" procedure was to reduce the systematic position preferences that some pilot subjects had displayed. After the time-out period the same stimulus arrangement was presented as that which immediately preceded the time out. Throughout all sessions the sample stimuli and the positions of the match stimuli and dark display window was varied in a random order.

Procedure I : Match or mismatch reinforced:

In sessions one through five, a press to any one of the match buttons under an illuminated stimulus display resulted in the delivery of a marble. This response was reinforced whether the stimulus over the button matched the sample stimulus or not. The purpose of this procedure was to establish a baseline measure of degree of matching accuracy when neither matching nor mismatching was differentially reinforced.

Procedure II: 0, 30, and 90 degree mismatch reinforced; 60 degree probes

In this procedure the subject was reinforced for pressing a choice button under a stimulus display which did not match the sample stimulus. Any mismatch to a 0, 30, 9r 90 degree sample resulted in the delivery of a marble, while a press to the match button under the stimulus which did match the sample stimulus resulted only in the presentation of a new sample stimulus. In sessions six through eight, the 60 degree sample stimulus was not presented, but 60 degree stimuli continued to be presented as possible match stimuli. In sessions nine and ten, the 60 degree sample stimulus was again presented as a sample stimulus, but either a match or mismatch response to the 60 degree sample stimulus resulted only in the presentation of a new sample stimulus.

Procedure III: 0, 30 and 90 degree match reinforced; 60 degree probes

The subjects were reinforced for pressing the match buttons under the stimulus display which matched 0, 30, and 90 degree sample stimuli. Either matches or mismatches to the 60 degree sample stimuli resulted in only the presentation of a new sample stimulus.

RESULTS AND DISCUSSION

Figure 1 and Figure 2 present the proportion of trials the sample

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Insert Figure 1 and Figure 2 about here

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stimuli were matched or mismatched for each subject under each of the experimental conditions. During the first procedure of the study in which either matching or mismatching was reinforced, both subjects displayed performances in which the majority of responses to the choice stimuli were to those that matched the sample stimuli, although this degree of matching was quite variable.

During Procedure II when only mismatching responses were reinforced for the 0, 30 and 90 degree samples, mismatching responses to these stimuli rose markedly. Further when the 60 degree sample probes were inserted, they also were mismatched on the majority of trials. It is important to note two features of these results. First, during procedure II there were no differential contingencies applied to either matching or mismatching the 60 degree sample stimuli. For either type of response the only consequence was to advance to the next sample stimulus. Secondly, during procedure II the extent to which the 60 degree sample stimuli was mismatched was markedly higher than the extent to which it was mismatched during procedure I. In procedure II since there were no differential consequences for mismatching the 60 degree sample stimuli and since the amount of mismatching of this stimulus was considerably higher than in procedure I, it seems likely that the development of mismatching of this stimulus may be attributed to reinforcement of mismatching for the 0, 30, and 90 degree samples. In other terms, an abstraction of mismatching had been developed, such that the 60 degree samples were mismatched even though there were no differential consequences for doing so, as long as mismatches were reinforced for the 0, 30, and 90 degree sample stimuli.

During procedure III the reinforcement contingencies for responses to the 0, 30, and 90 degree sample stimuli were changed, Now only matching responses to these sample stimuli were reinforced, while neither matching nor mismatching was reinforced for the 60 degree sample stimuli. Under these conditions both subjects displayed a sharply increased proportion of matching responses for the 0, 30, and 90 degree sample stimuli. Both subjects also showed an increased proportion of matching responses to the 60 degree sample stimuli during procedure III as compared to procedure II, although, the effect is more clearly pronounced for subject 1 than for subject 2. Again the results indicate the formation of an abstraction (this time of "matching") which produced generalized effects upon matching responses which were not directly reinforced.

The results of this study indicate that a generalized type of matching or mismatching repertoire can be established in children such that whether or not certain sample stimuli are matched or mismatched can be a function of reinforcement for matching or mismatching other stimuli. In terms of the generalized effects upon responses not directly manipulated, these results are similar to those obtained by Baer and Sherman (1964), Lovaas, Berberich, Perloff and Schaeffer (1966) and by Baer, Peterson, and Sherman (1967) dealing with the development of imitative response classes in children.

FOOTNOTES

1. The research reported herein was performed pursuant to a contract with the Office of Economic Opportunity, Executive Office of the President, Washington, D.C., 20506. The opinions expressed herein are those of the author and should not be construed as representing the opinion or policy of any agency of the United States Government.

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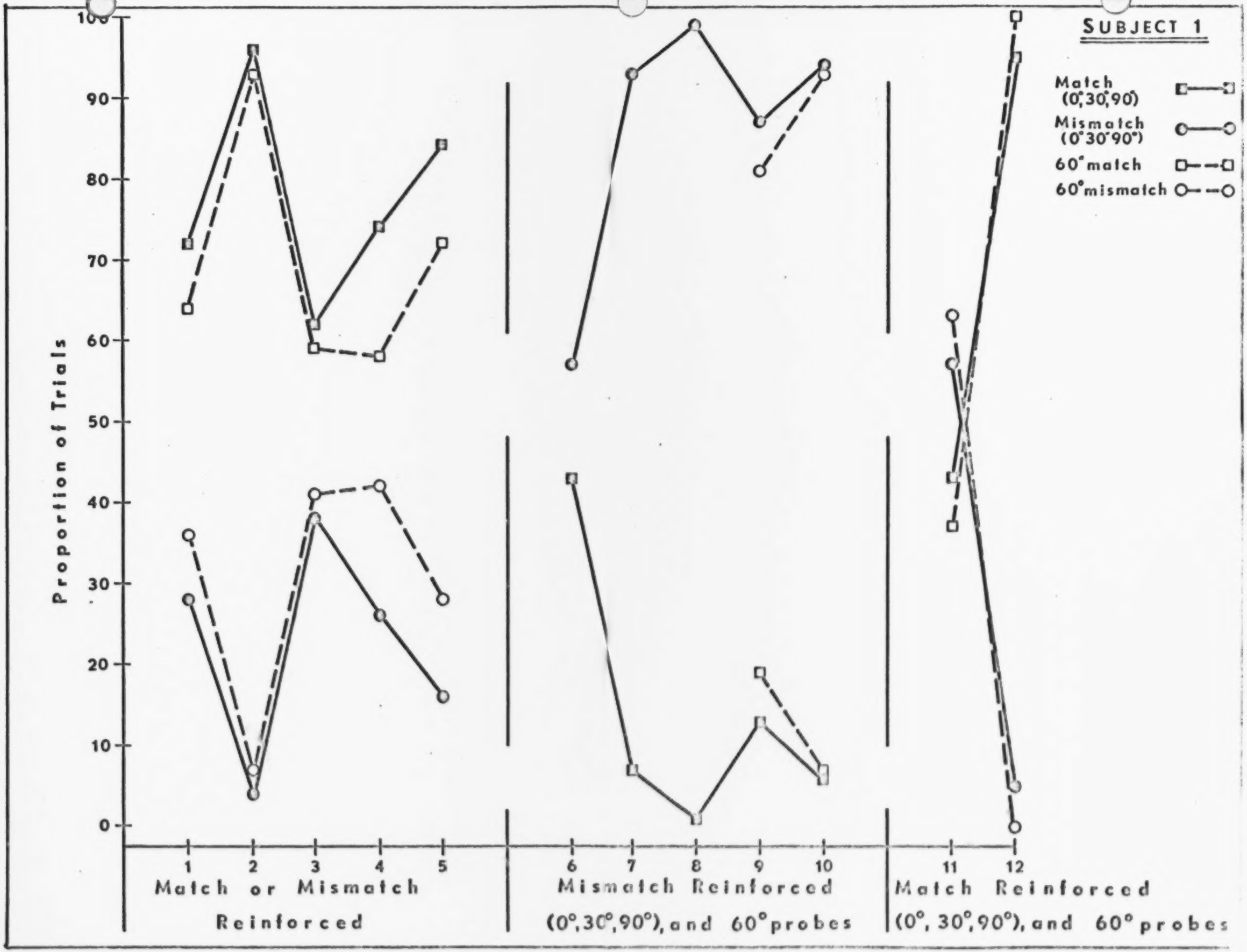
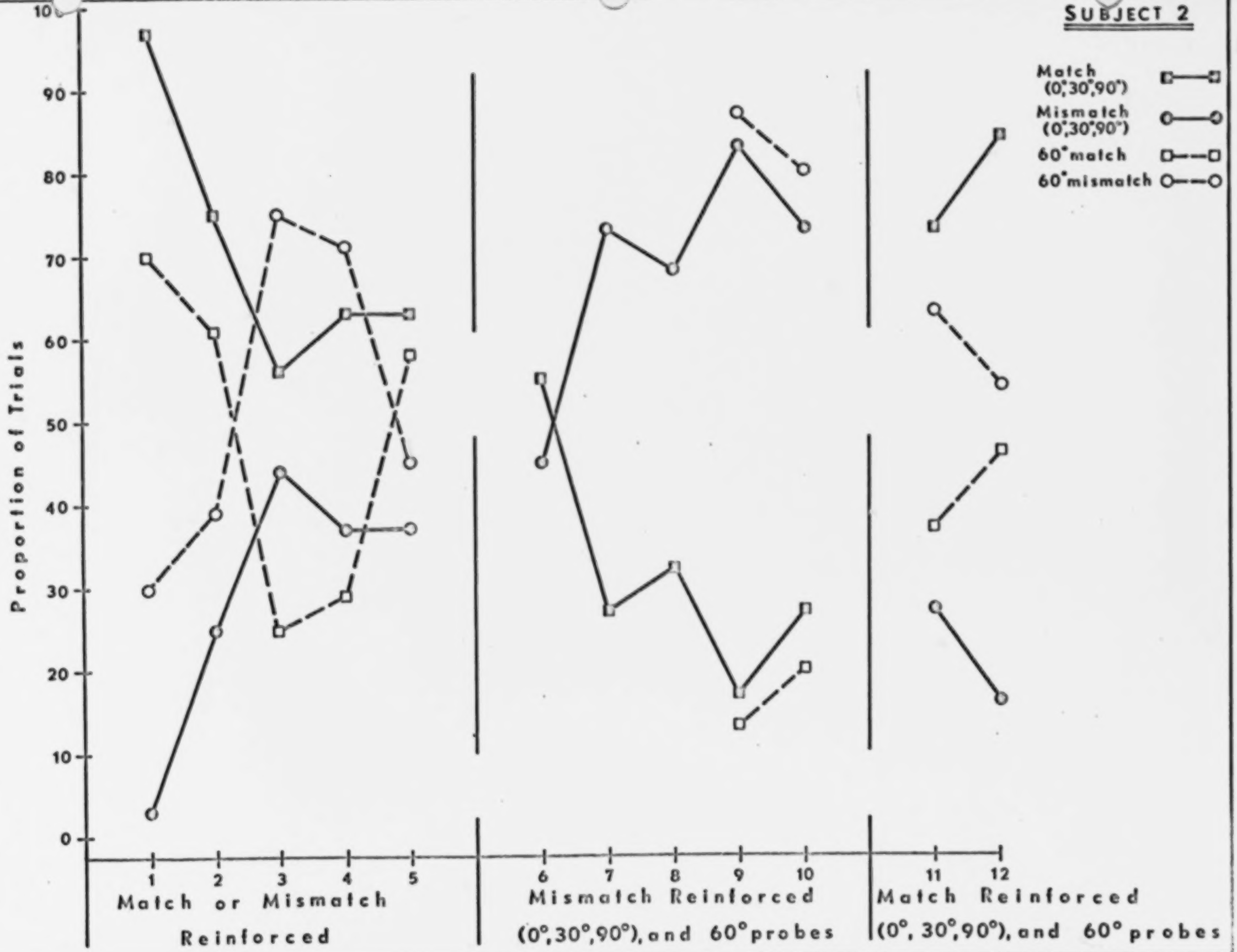

SUBJECT 1
Match (0°,30°,90°)
Mismatch (0°30°90°)
60° match
60° mismatch
Proportion of Trials
100
90
80
70
60
50
40
30
20
10
0
1 2 3 4 5
Match or Mismatch Reinforced
6 7 8 9 10
Mismatch Reinforced (0°,30°,90°), and 60° probes
11 12
Match Reinforced (0°, 30°,90°), and 60° probes

SUBJECT 2


Match (0°,30°,90°)
Mismatch (0°,30°,90°)
60° match
60° mismatch
Proportion of Trials
0
10
20
30
40
50
60
70
80
90
100
1
2
3
4
5
Match or Mismatch Reinforced
6
7
8
9
10
Mismatch Reinforced (0°,30°,90°), and 60° probes
11
12
Match Reinforced (0°, 30°,90°), and 60° probes